JP 2000-277477
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CLAIMS

[Claim(s)]
[Claim 1] The clearance used as a fluid channel is formed between the processing plates countered and formed in front flesh-side both sides of a processed substrate, and them. It is the fluid art which has the process which supplies a fluid to the clearance which pours in a fluid from the center section of the processing plate, and serves as said fluid channel while rotating a processed substrate and a processing plate relatively. The fluid art of the substrate which has the process which carries out fluid processing of the front face of said processed substrate, and changes in the condition of having made the ground grounding said processing plate while surface specific resistance constitutes said processing plate from a conductive ingredient which is less than [1Gohm].
[Claim 2] The clearance used as a fluid channel is formed between the processing plates countered and formed in front flesh-side both sides of a processed substrate, and them. While being the fluid art which has the process which supplies a fluid to the clearance which pours in a fluid from the center section of the processing plate, and serves as said fluid channel and constituting said processing plate from a conductive ingredient whose surface specific resistance is less than [1Gohm], rotating a processed substrate The fluid art of the substrate which has the process which carries out fluid processing of the front face of said processed substrate, and changes in the condition of having made the ground grounding said processing plate.
[Claim 3] Claim 1 which constitutes the front face of the above-mentioned processing plate which counters a processed substrate at least from a processing substrate which performed chemical-resistant processing, and changes, or the fluid art of a substrate given in two.
[Claim 4] The processing plate which formed the clearance which counters the chuck device in which a processed substrate is held, and front flesh-side both sides of said processed substrate, and serves as a fluid channel at these opposed faces, and was formed, It is the fluid processor which has a means to supply a fluid to the clearance which pours in a fluid from the center section of said processing plate, and serves as said fluid channel while rotating said processed substrate and processing plate relatively. The fluid processor of the substrate which grounds said processing plate to a ground, and constitutes and grows it into it while surface specific resistance constitutes said processing plate from a conductive ingredient which is less than [1Gohm].
[Claim 5] The processing plate which formed the clearance which counters the chuck device which carries out rotation maintenance of the processed substrate, and front flesh-side both sides of said processed substrate, and serves as a fluid channel at these opposed faces, and was formed, It is the fluid processor which has a means to supply a fluid to the clearance which pours in a fluid from the center section of said processing plate, and serves as said fluid channel while rotating said processed substrate. The fluid processor of the substrate which grounds said processing plate to a ground, and constitutes and grows it into it while surface specific resistance constitutes said processing plate from a conductive ingredient which is less than [1Gohm].
[Claim 6] Claim 4 which constitutes the front face of the above-mentioned processing plate which counters a processed substrate at least from a processing substrate which performed chemical-resistant processing, and changes, or the fluid art of a substrate given in five.
[Claim 7] The clearance used as a fluid channel is formed between the processing plates countered and formed in front flesh-side both sides of a processed substrate, and them. It is the fluid art which has the process which supplies a fluid to the clearance which pours in a fluid from the center section of the processing plate, and serves as said fluid channel while rotating a processed substrate and a processing plate relatively. The fluid art of the substrate which has the process which carries out fluid processing of the front face of a processed substrate, and changes in the condition of having made the ground grounding the front face where covering processing of said processing plate was carried out while specific resistance carried out covering processing of the front face of said processing plate which counters a processed substrate at least with the conductive ingredient not more than 1Gohm.

[Claim 8] The clearance used as a fluid channel is formed between the processing plates countered and formed in front flesh-side both sides of a processed substrate, and them. It is the fluid art which has the process which supplies a fluid to the clearance which pours in a fluid from the center section of the processing plate, and serves as said fluid channel while rotating a processed substrate. The fluid art of the substrate which has the process which carries out fluid processing of the front face of a processed substrate, and changes in the condition of having made the ground grounding the front face where covering processing of said processing plate was carried out while specific resistance carried out covering processing of the front face of said processing plate which counters a processed substrate at least with the conductive ingredient not more than 1Gohm.

[Claim 9] The processing plate which formed the clearance which counters the chuck device in which a processed substrate is held, and front flesh-side both sides of said processed substrate, and serves as a fluid channel at these opposed faces, and was formed, It is the fluid processor which has a means to supply a fluid to the clearance which pours in a fluid from the center section of said processing plate, and serves as said fluid channel while rotating said processed substrate and processing plate relatively. The fluid processor of the substrate which grounds to a ground the front face where covering processing of said processing plate was carried out, and constitutes and grows it into it while specific resistance carries out covering processing of the front face of said processing plate which counters a processed substrate at least with the conductive ingredient not more than 1Gohm.

[Claim 10] The processing plate which formed the clearance which counters the chuck device which carries out rotation maintenance of the processed substrate, and front flesh-side both sides of said processed substrate, and serves as a fluid channel at these opposed faces, and was formed, It is the fluid processor which has a means to supply a fluid to the clearance which pours in a fluid from the center section of said processing plate, and serves as said fluid channel while rotating said processed substrate. The fluid processor of the substrate which grounds to a ground the front face where covering processing of said processing plate was carried out, and constitutes and grows it into it while specific resistance carries out covering processing of the front face of said processing plate which counters a processed substrate at least with the conductive ingredient not more than 1Gohm.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the fluid art and processor of a substrate, especially relates to the fluid art and processor of a suitable substrate to carry out fluid processing of the tabular ingredients, such as a semi-conductor wafer, a liquid crystal substrate, and a magnetic disk, by the sheet method as a processed substrate.
[0002]
[Description of the Prior Art] While the fluid processor by sheet methods, such as the conventional semi-conductor substrate, rotates a substrate, the washing station which turns processing fluids, such as a liquid or a gas (gas), to a substrate, and irradiates them is known (for example, JP,4-287922,A). Washing -> rinse -> when performing desiccation processing, a penetrant remover is processed [nitrogen / the 3rd nozzle to] by turning to a substrate and irradiating one by one in the 2nd nozzle to a rinse from the 1st nozzle, rotating a substrate.
[0003] When irradiating a penetrant remover or a rinse and rotating a substrate, a penetrant remover or a rinse adheres to a processing tub wall. If desiccation processing is started, in order to carry out the high-speed revolution of the substrate, the descending current which faces to a substrate with a revolution occurs, and an eddy air current occurs within a processing tub. The penetrant remover or rinse adhering to a processing tub wall rides on this eddy air current, adheres to a substrate front face, and causes resoiling.
[0004] There is a method of countering a substrate and installing a plate as an approach of preventing resoiling to the above-mentioned substrate, for example, the washing station of JP,8-130202,A and JP,8-78368,A is known. These are processed by being crowded with a washing plate on both sides of a substrate from the upper and lower sides, and carrying out sequential supply of a penetrant remover, a rinse, or the nitrogen gas from a center, and since they can prevent the air current which faces to a substrate with a washing plate even when a high-speed revolution is carried out they can prevent resoiling on the front face of a substrate.
[0005]
[Problem(s) to be Solved by the Invention] For example, it is necessary to control the ambient atmosphere after washing by the process which should control growth of the natural oxidation film in front of the gate oxide formation process of the production process of a semi-conductor etc. to a high level for oxidization control. With the large equipment of the conventional processing space, in order for the permutation of an ambient atmosphere to take time amount, it is necessary to make processing space small as much as possible. Moreover, the consumption of a processing fluid is also reducible by making processing space small.
[0006] However, when desiccation processing is performed for spacing of the washing plate 1 and the processed substrate 2 as 0.6mm to 1.0mm using the equipment shown in drawing 2 , poor desiccation occurs selectively after desiccation processing. In addition, in drawing 2 , 1a and 1b are fluid feed hoppers, and supply a penetrant remover required for fluid processing, the gas for desiccation, etc. from here.
[0007] As a result of investigating in a detail the cause which this poor desiccation generates, it turned out that waterdrop remains on a substrate with static electricity generated by revolution of a substrate 2, and poor desiccation occurs by the reaction of a substrate front face and waterdrop.
[0008] Especially, in the rinse -> desiccation processing after the natural oxidation film clearance before the gate oxide formation process in a semi-conductor production process, or the rinse -> desiccation processing after the natural oxidation film clearance before membrane formation of the wiring material to a contact hole pars basilaris ossis occipitalis, drying [which is called a water mark] will become poor, and the quality of a product will be degraded remarkably. Static electricity furthermore generated on the substrate front face poses a problem, in order to cause the reattachment of a foreign matter.
[0009] In the washing station of a semi-conductor, in order to prevent resoiling within equipment, the plastic material

the amount of wetted part excelled in chemical resistance by high grades, such as polytetrafluoroethylene and a polyether ether ketone, is used. These plastic material tends to be charged and tends to generate static electricity by the frictional electrification especially by revolution.
[0010] When the static electricity potential generated on the washing plate front face after performing desiccation processing using the washing plate 1 made from polytetrafluoroethylene was measured, as shown in drawing 3 , it turned out that potential increases to negative toward the washing plate periphery, and it is decreasing by the outermost periphery. Furthermore, when the static electricity potential on a substrate 2 was measured, it turned out that a part with the high absolute value of potential is in the almost same location as the washing plate 1 as shown in drawing 4 .
[0011] Moreover, when poor desiccation was measured, it turned out that it is easy to happen to the part which static electricity on a substrate 2 generates most as shown in drawing 5 . The rinse which was made to increase a rotational frequency (from 100rpm to for example, 1000rpm), and was inserted into the substrate front face and the penetrant remover when changing from rinse processing to desiccation processing serves as waterdrop, and is emitted to the exterior of a substrate by the centrifugal force. However, it generates, as static electricity generated by revolution show drawing 3 and drawing 4 , and waterdrop is attracted by static electricity, it remains between a substrate 2 and the washing plate 1, and it is thought that poor desiccation of a substrate is caused.
[0012] Therefore, it is in the object of this invention canceling the above-mentioned conventional trouble, and is in offering the fluid art and fluid processor of a substrate which are not made to generate poor desiccation in the desiccation processing after fluid processing of washing etc. by preventing generating of static electricity.
[0013]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it becomes important from rinse termination to prevent generating of static electricity at the time of desiccation initiation. In this invention, the object can be attained by the first described below - the third technique.
[0014] The description of the first technique forms the clearance used as a fluid channel first between the processing plates countered and formed in front flesh-side both sides of a processed substrate, and them. It is the fluid art which has the process which supplies a fluid to the clearance which pours in a fluid from the center section of the processing plate, and serves as said fluid channel while rotating a processed substrate and a processing plate relatively. While surface specific resistance constitutes said processing plate from a conductive ingredient which is less than [1Gohm], it is the fluid art of the substrate which has the process which carries out fluid processing of the front face of said processed substrate, and changes in the condition of having made the ground grounding said processing plate.
[0015] The processing plate which formed the clearance which this fluid art counters the chuck device in which a processed substrate is held, and front flesh-side both sides of said processed substrate, and serves as a fluid channel at these opposed faces, and was formed, It is the fluid processor which has a means to supply a fluid to the clearance which pours in a fluid from the center section of said processing plate, and serves as said fluid channel while rotating said processed substrate and processing plate relatively. While surface specific resistance constitutes said processing plate from a conductive ingredient which is less than [1Gohm], said processing plate is realizable with the fluid processor of the substrate which grounds to a ground, and constitutes and grows into it.
[0016] In order to remove static electricity generally, a structural material is used as a non-charged ingredient and it is called need that surface specific resistance is less than [1Gohm]. Therefore, in order to make a processing plate demonstrate the antistatic effectiveness, it is required to carry out ground touch-down as less than [specific resistance 1Gohm].
[0017] Since the above-mentioned processing plate does not have generating of static electricity and there is no generating of static electricity also on the processed substrate which is a tabular ingredient further, poor desiccation is not generated.
[0018] The description of the second technique forms the clearance used as a fluid channel between the processing plates countered and formed in front flesh-side both sides of a processed substrate, and them. It is the fluid art which has the process which supplies a fluid to the clearance which pours in a fluid from the center section of the processing plate, and serves as said fluid channel while rotating a processed substrate and a processing plate relatively. While specific resistance carries out coat processing of the front face of said processing plate which counters a processed substrate at least with the conductive ingredient not more than 1Gohm, it is the fluid art of the substrate which has the process which carries out fluid processing of the front face of a processed substrate, and changes in the condition of having made the ground grounding the front face where coat processing of said processing plate was carried out.
[0019] And the chuck device in which this fluid art holds a processed substrate, The processing plate which formed the clearance which counters front flesh-side both sides of said processed substrate, and serves as a fluid channel at these opposed faces, and was formed, It is the fluid processor which has a means to supply a fluid to the clearance which pours in a fluid from the center section of said processing plate, and serves as said fluid channel while rotating said

processed substrate and processing plate relatively. While specific resistance carries out coat processing of the front face of said processing plate which counters a processed substrate at least with the conductive ingredient not more than 1Gohm, the front face where coat processing of said processing plate was carried out is realizable with the fluid processor of the substrate which grounds to a ground, and constitutes and grows into it.

[0020] In this second technique, when it constitutes a processing plate from insulating materials, such as a ceramic and plastics, or a metal of high resistance, it is suitable.

[0021] Since generating of static electricity to a processing plate and a processed substrate does not take place as well as the first technique when a front face is covered with the above-mentioned conductive ingredient, poor desiccation can be prevented.

[0022] The description of the third technique is constituting the front face of the processing plate (conductive ingredient whose specific resistance's is less than [1Gohm]) in the first technique of the above which counters a processed substrate at least from a processing substrate which performed chemical-resistant processing. By this, variou kinds of processing drug solutions can be used as a processing fluid, and the durable time amount of a processing plate can also be extended. As chemical-resistant processing in this case, the processing which covers ingredients, such as diamond coating, conductive polytetrafluoroethylene, and a polyether ether ketone, is applicable, for example.

[0023] In addition, also rotating the ** processed substrate and processing plate which is made to rotate ** processed substrate for example, and fixes the processing plate as a method which rotates a processed substrate and a processing plate relatively and which is made to rotate ** processing plate and fixes the processed substrate (hard flow being mutually rotated in this case, or the case of this direction making rotational speed different) etc. occurs in the above-mentioned all directions type.

[0024] Although it can carry out with any rotary system, the method of ** especially becomes easy [an equipment configuration] as the amount of moving part is few [else], and it excels in practicability. In this case, what is necessary is just to give a revolution function to the chuck device in which a processed substrate is held.

[0025]

[Embodiment of the Invention] Here, the case where it is adapted for a washing station in this invention is made into ar example, and it explains. Drawing 1 is the cross-section schematic diagram having shown the important section of this invention washing station typically. In drawing 1 , 3 and 5 are the up washing plates and lower washing plates used as : processing plate, respectively, and the fluid feed hoppers 3a and 5a are formed in the center section, respectively. The substrate supporting structure equipped with the chuck device in which 4 holds a processed substrate and 6 holds a processed substrate is shown.

[0026] Respectively the clearance between fixed spacing is formed between the processed substrates 4, it is arranged in it, sequential supply of the fluid required for washing is carried out in this clearance according to a washing process from the fluid feed hoppers 3a and 5a, and the up washing plate 3 and the lower washing plate 5 have the composition that fluid processing of a processed substrate is performed. That is, according to the washing process, a penetrant remover, a rinse, the gas for desiccation, etc. have structure by which sequential supply is carried out by the change-over bulb at the fluid feed hoppers 3a and 5a.

[0027] and the conductor of the front face of these washing plates 3 and 5 which counters a processed substrate at least -- the section has the structure where ground touch-down is carried out, respectively and a washing plate is not charged

[0028] Although considered as the configuration which the substrate supporting structure 6 which fixed the washing plates 3 and 5 and held the processed substrate 4 rotates with this equipment, it is good also as a configuration which the substrate supporting structure 6 is fixed [configuration] to reverse, and it considers [configuration] as the configuration which rotates the washing plates 3 and 5, or rotates these both further. It is important to rotate relatively the washing plates 3 and 5 used as a processing plate and the processed substrate 4, and it is that a fluid flows a clearance by it and the front face of the processed substrate 4 is pinched by homogeneity with a fluid here.

[0029] What is necessary is to use conductors, such as corrosion-resistant metals, such as stainless steel, conductive carbon, and an electroconductive-plastics Plastic solid that plastics was made to distribute the conductive matter furthe and gave conductivity, for example, and just to choose corrosive resistant construction material suitably according to the class of penetrant remover from these as the up washing plate used as a processing plate, and lower washing plates 3 and 5. Moreover, like an insulating material, in the case of high resistance material, the base material used as a processing plate covers a conductor layer on a processing plate front face, and should just conductor-ize a front face.

[0030] The processed substrate 4 is suitably chosen by the washing objects, such as for example, a semi-conductor substrate (wafer), a magnetic-disk substrate, an optical disk substrate, and a liquid crystal substrate. And the processed substrate 4 is held by the substrate supporting structure 6 equipped with the chuck device free [attachment and detachment].

[0031] In addition, although this example explained the fluid art and equipment which process simultaneously both sides of the processed substrate 4, it is also possible to process only one side if needed. In that case, what is necessary i just to suspend fluid supply of either an up washing plate and the lower washing plates 3 and 5. Moreover, when aiming at fluid processing of only one side from the start, it is also possible to omit either an up washing plate and the lower washing plates 3 and 5, and to simplify an equipment configuration.

[0032]

[Example] Hereafter, the washing station shown in drawing 1 is explained to an example about the fluid art and processor of a substrate of this invention.

<Examples 1-2> A substrate 4 is held by the substrate supporting structure 6, and rotates the substrate supporting structure 6 by the hollow motor. The up washing plate 3 and the lower washing plate 5 are being fixed. The processing fluid has the structure where change from the center section of the vertical washing plate, and sequential supply of a penetrant remover, a rinse, and the nitrogen for desiccation is carried out by the bulb.

[0033] In order to prevent generating of static electricity, the conductive carbon ingredient was used for the up washing plate 3, and it grounded to the ground. The static electricity potential measurement result of the washing plate front fac after desiccation processing is shown in drawing 6 R> 6. It turned out that static electricity is not generated at all the whole surface from this drawing.

[0034] Moreover, the conditions of washing down stream processing are the same as that of the example of a comparison (conventional example) shown below, and displayed the result on a table 1 collectively.

[0035] Comparative experiments were conducted using the product made from carbon (example 1), and the up washing plate 3 made from polytetrafluoroethylene (example 2) which carried out the carbon coat as an example of this invention, using the up washing plate 3 made from polytetrafluoroethylene as a conventional example.

[0036] moreover, the conventional example and the example of this invention -- as for the lower washing plate 5, both used the product made from polytetrafluoroethylene. As a processed substrate 4, in order to make generating of poor desiccation easy to check, the silicon wafer which formed the polish recon which doped Lynn upwards was used for th detailed pattern which gave the level difference of 500nm.

[0037] First, the polish recon membrane formation side which doped Lynn of the silicon wafer used as the processed side of a substrate 4 is held to the substrate supporting structure 6 so that the up washing plate 3 may be met.

[0038] Subsequently, in order to rotate a substrate 4 by 100rpm and to remove contamination, after it processed in the mixed water solution of ammonia and a hydrogen peroxide and ultrapure water performed the rinse, in order to remove the natural oxidation film, it processed in the fluoric acid water solution, and ultrapure water performed the rinse. Then while raising the rotational frequency of a substrate to 1000rpm, nitrogen gas was supplied and desiccation processing was performed.

[0039] The substrate front face after processing (polish recon membrane formation side which doped Lynn) was completely observed with the scanning electron microscope, and the occurrences of poor desiccation were counted. Th result is shown in a table 1.

[0040] Processing which does not have generating of poor desiccation by this invention was able to be performed as shown in a table 1.

[0041]

[A table 1]

<表1>

処理板3の仕様	乾燥不良数 (個／8インチウエハ)
カーボン製洗浄板 （実施例1）	0
カーボン被覆ポリテトラフルオロエチレン製洗浄板（実施例2）	0
ポリテトラフルオロエチレン製洗浄板 （比較例）	25

[0042] <Example 3> The sample of the magnetic-disk substrate which formed the nickel-P plating film in both sides of an aluminum containing alloy substrate as a processed substrate 4 was carried out, and washing processing was performed. The up washing plate 3 and the lower washing plate 5 used as a processing plate were grounded to the ground using the same conductive carbon ingredient as an example 1, respectively. Sequential supply of a well-known penetrant remover, a rinse, and the gas for desiccation was carried out from the fluid feed hoppers 3a and 5a, respectively, and washing / desiccation processing was performed by the same approach as an example 1. Consequently, the cleaning effect with good both sides of a substrate 4 was acquired.

[0043]

[Effect of the Invention] As explained in full detail above, this invention was able to attain the desired end. That is, it

can process by using the fluid art and fluid processor of this invention, without generating poor desiccation of a substrate.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The important section cross-section schematic diagram of this invention equipment.
[Drawing 2] The important section sectional view of conventional equipment.
[Drawing 3] Property drawing which displayed the static electricity potential conventionally generated on the washing plate front face of equipment by relation with the distance from a washing plate core.
[Drawing 4] Property drawing which displayed the static electricity potential on the substrate conventionally generated with equipment by relation with the distance from a washing plate core.
[Drawing 5] The distribution map of poor desiccation conventionally generated on the substrate with equipment.
[Drawing 6] Property drawing which displayed the static electricity potential generated on the washing plate front face of this invention equipment by relation with the distance from a washing plate core.
[Description of Notations]
1 -- Washing plate,
1a, 1b -- Fluid feed hopper,
2 -- Substrate,
3 -- Up washing plate,
3a -- Fluid feed hopper,
4 -- Substrate,
5 -- Lower washing plate,
5a -- Fluid feed hopper,
6 -- Substrate supporting structure.

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PATENT ABSTRACTS OF JAPAN

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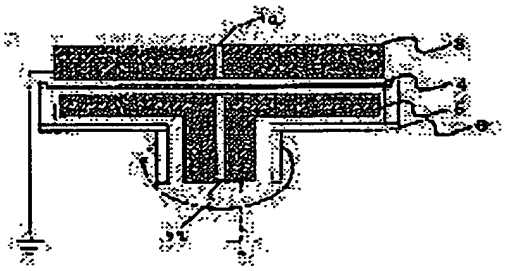
(71)Applicant : HITACHI LTD
KOKUSAI ELECTRIC CO LTD
(72)Inventor : TAKAHARA YOICHI
SAEKI TOMONORI
DAIROKU NORIYUKI
TANAKA YUICHIRO
AIUCHI SUSUMU
OKA HITOSHI
MORITA FUMIO
FUJISHIRO MASATAKA
YAMAOKA AKINOBU

(54) SUBSTRATE FLUID PROCESSING METHOD AND EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent drying marks on a substrate caused by static electricity and water droplets in a device which processes the substrate with fluid as it rotates.
SOLUTION: Cleaning plates 3 and 5 sandwiching a substrate 4 between them are formed of conductive material and grounded, by which static electricity is prevented from being generated. In a state where the substrate 4 is rotated, cleaning fluid is supplied to the gaps between the cleaning plates 3 and 5 and the substrate 4 through fluid feed openings 3a and 5a each provided to the centers of the plates 3 and 5 to clean the substrate 4, and the substrate 4 is dried out. By this setup, the substrate 4 can be processed without producing drying marks on its surface.



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審査請求　未請求　請求項の数10　ＯＬ　（全７頁）

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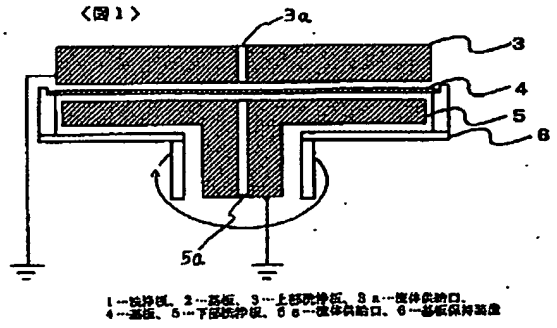
(71)出願人　000005108
株式会社日立製作所
東京都千代田区神田駿河台四丁目６番地
(71)出願人　000001122
国際電気株式会社
東京都中野区東中野三丁目14番20号
(72)発明者　高原　洋一
神奈川県横浜市戸塚区吉田町292番地　株式会社日立製作所生産技術研究所内
(74)代理人　100061893
弁理士　高橋　明夫　（外１名）

最終頁に続く

(54)【発明の名称】　基板の流体処理方法及び処理装置

(57)【要約】
【課題】基板を回転させながら流体で処理する装置においては、静電気と水滴による乾燥不良を防止することが困難であり、これを克服することが可能な流体処理方法及び装置を実現する。
【解決手段】被処理基板４を挟み込む洗浄板３、５を導電性材料とし、アース接地することによって静電気の発生を防止する。基板４を回転させた状態で洗浄板３、５の中央部に設けた流体供給口３ａ、５ａから、洗浄に必要な流体を洗浄板３、５と基板４との隙間に供給し、被処理基板４を洗浄し乾燥処理する。被処理基板４の乾燥不良を発生させずに処理を行うことができる。



【特許請求の範囲】
【請求項１】被処理基板の表裏両面とそれらに対向して設けられた処理板との間に流体通路となる隙間を形成し、被処理基板と処理板とを相対的に回転させながら処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する工程を有する流体処理方法であって、前記処理板を表面固有抵抗が１ＧΩ以下である導電性材料で構成すると共に、前記処理板をアースに接地させた状態で前記被処理基板の表面を流体処理する工程を有して成る基板の流体処理方法。
【請求項２】被処理基板の表裏両面とそれらに対向して設けられた処理板との間に流体通路となる隙間を形成し、被処理基板を回転させながら処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する工程を有する流体処理方法であって、前記処理板を表面固有抵抗が１ＧΩ以下である導電性材料で構成すると共に、前記処理板をアースに接地させた状態で前記被処理基板の表面を流体処理する工程を有して成る基板の流体処理方法。
【請求項３】上記処理板の少なくとも被処理基板に対向する表面を耐薬品性処理を行った処理基板で構成して成る請求項１もしくは２記載の基板の流体処理方法。
【請求項４】被処理基板を保持するチャック機構と、前記被処理基板の表裏両面に対向し、かつこれら対向面に流体通路となる隙間を形成して設けられた処理板と、前記被処理基板と処理板とを相対的に回転させながら前記処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する手段とを有する流体処理装置であって、前記処理板を表面固有抵抗が１ＧΩ以下である導電性材料で構成すると共に、前記処理板をアースに接地して構成して成る基板の流体処理装置。
【請求項５】被処理基板を回転保持するチャック機構と、前記被処理基板の表裏両面に対向し、かつこれら対向面に流体通路となる隙間を形成して設けられた処理板と、前記被処理基板を回転させながら前記処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する手段とを有する流体処理装置であって、前記処理板を表面固有抵抗が１ＧΩ以下である導電性材料で構成すると共に、前記処理板をアースに接地して構成して成る基板の流体処理装置。
【請求項６】上記処理板の少なくとも被処理基板に対向する表面を耐薬品性処理を行った処理基板で構成して成る請求項４もしくは５記載の基板の流体処理方法。
【請求項７】被処理基板の表裏両面とそれらに対向して設けられた処理板との間に流体通路となる隙間を形成し、被処理基板と処理板とを相対的に回転させながら処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する工程を有する流体処理方法であって、前記処理板の少なくとも被処理基板に対向する表面を固有抵抗が１ＧΩ以下の導電性材料で被覆処理すると共に、前記処理板の被覆処理された表面をアースに接地させた状態で被処理基板の表面を流体処理する工程を有して成る基板の流体処理方法。
【請求項８】被処理基板の表裏両面とそれらに対向して設けられた処理板との間に流体通路となる隙間を形成し、被処理基板を回転させながら処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する工程を有する流体処理方法であって、前記処理板の少なくとも被処理基板に対向する表面を固有抵抗が１ＧΩ以下の導電性材料で被覆処理すると共に、前記処理板の被覆処理された表面をアースに接地させた状態で被処理基板の表面を流体処理する工程を有して成る基板の流体処理方法。
【請求項９】被処理基板を保持するチャック機構と、前記被処理基板の表裏両面に対向し、かつこれら対向面に流体通路となる隙間を形成して設けられた処理板と、前記被処理基板と処理板とを相対的に回転させながら前記処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する手段とを有する流体処理装置であって、前記処理板の少なくとも被処理基板に対向する表面を固有抵抗が１ＧΩ以下の導電性材料で被覆処理すると共に、前記処理板の被覆処理された表面をアースに接地して構成して成る基板の流体処理装置。
【請求項１０】被処理基板を回転保持するチャック機構と、前記被処理基板の表裏両面に対向し、かつこれら対向面に流体通路となる隙間を形成して設けられた処理板と、前記被処理基板を回転させながら前記処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する手段とを有する流体処理装置であって、前記処理板の少なくとも被処理基板に対向する表面を固有抵抗が１ＧΩ以下の導電性材料で被覆処理すると共に、前記処理板の被覆処理された表面をアースに接地して構成して成る基板の流体処理装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、基板の流体処理方法及び処理装置に係り、特に被処理基板として半導体ウエハ、液晶基板、磁気ディスク等の板状材料を枚葉方式で流体処理するに好適な基板の流体処理方法及び処理装置に関する。
【０００２】
【従来の技術】従来の半導体基板等の枚葉方式による流体処理装置は、基板を回転させながら液体もしくは気体（ガス）等の処理流体を基板に向けて照射する洗浄装置が知られている（例えば特開平４－２８７９２２号公報）。洗浄→リンス→乾燥処理を行う場合、基板を回転させながら第１のノズルから洗浄液を、第２のノズルからリンス液を、第３のノズルから窒素を、順次基板に向けて照射し処理を行う。
【０００３】洗浄液またはリンス液を照射し基板を回転

させた場合、洗浄液またはリンス液が処理槽内壁に付着する。乾燥処理に入ると基板を高速回転するため、回転に伴い基板に向かう下降気流が発生し処理槽内でうず気流が発生する。処理槽内壁に付着した洗浄液またはリンス液が、このうず気流に乗り、基板表面に付着し再汚染を引き起こす。

【0004】上記基板への再汚染を防止する方法として、基板に対向して板を設置する方法があり、例えば特開平8-130202号公報、特開平8-78368号公報の洗浄装置が知られている。これらは、基板を上下から洗浄板で挟みこみ中央より洗浄液、リンス液または窒素ガスを順次供給することによって処理するものであり、高速回転した場合でも基板に向かう気流を洗浄板で防止できるため、基板表面への再汚染を防止できる。

【0005】

【発明が解決しようとする課題】例えば半導体の製造工程のゲート酸化膜形成工程前などの自然酸化膜の成長を抑制すべき工程では、洗浄後の雰囲気を酸化抑制のため高レベルに制御する必要がある。従来の処理空間の広い装置では、雰囲気の置換に時間を要するため極力処理空間を小さくする必要がある。また、処理空間を小さくすることによって処理流体の消費量を削減することもできる。

【0006】ところが、図2に示す装置を用いて洗浄板1と被処理基板2との間隔を0.6mmから1.0mmとして乾燥処理を行った場合、乾燥処理後に部分的に乾燥不良が発生する。なお、図2において、1a及び1bは流体供給口であり、ここから流体処理に必要な洗浄液や乾燥のためのガス等を供給する。

【0007】この乾燥不良が発生する原因を詳細に調べた結果、基板2の回転により発生する静電気により水滴が基板上に残留し、基板表面と水滴の反応により乾燥不良が発生することがわかった。

【0008】特に、半導体製造工程におけるゲート酸化膜形成工程前の自然酸化膜除去後のリンス→乾燥処理または、コンタクトホール底部への配線材料の成膜前の自然酸化膜除去後のリンス→乾燥処理においては、ウォータマークと呼ばれる乾燥不良となり、製品の品質を著しく劣化させてしまう。さらに基板表面に発生した静電気は異物の再付着を引き起こすために問題となる。

【0009】半導体の洗浄装置では、装置内での再汚染を防止するために接液部分はポリテトラフルオロエチレンやポリエーテルエーテルケトンなどの高純度で耐薬品性に優れたプラスチック材料が用いられている。これらプラスチック材料は帯電し易く、特に回転による摩擦帯電による静電気を発生しやすい。

【0010】ポリテトラフルオロエチレン製の洗浄板1を用いて乾燥処理を行った後の洗浄板表面に発生する静電気電位を測定したところ、図3に示すごとく電位は洗浄板外周に向かって負に増加していき最外周で減少していることがわかった。さらに、基板2上の静電気電位を測定したところ図4に示すごとく洗浄板1とほぼ同じ位置に電位の絶対値の高い部分があることがわかった。

【0011】また、乾燥不良を測定したところ、図5に示すごとく基板2上の静電気の最も発生する部分に起こり易いことがわかった。リンス処理から乾燥処理に切り替える時に回転数を増加させ（例えば100rpmから1000rpmに）基板表面と洗浄液に挟まれたリンス液が、遠心力によって水滴となり基板の外部に放出される。ところが、回転により発生した静電気が図3、図4に示す様に発生し、水滴が静電気に吸引され基板2と洗浄板1との間に残留し、基板の乾燥不良を引き起こすものと考えられる。

【0012】したがって、本発明の目的は上記従来の問題点を解消することにあり、静電気の発生を防止することにより洗浄等の流体処理後の乾燥処理において、乾燥不良を発生させない基板の流体処理方法及び流体処理装置を提供することにある。

【0013】

【課題を解決するための手段】上記課題を解決するためには、リンス終了から乾燥開始時に静電気の発生を防止することが重要となる。本発明においては、以下に述べる第一～第三の手法によって目的を達成することができる。

【0014】まず第一の手法の特徴は、被処理基板の表裏両面とそれらに対向して設けられた処理板との間に流体通路となる隙間を形成し、被処理基板と処理板とを相対的に回転させながら処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する工程を有する流体処理方法であって、前記処理板を表面固有抵抗が1GΩ以下である導電性材料で構成すると共に、前記処理板をアースに接地させた状態で前記被処理基板の表面を流体処理する工程を有して成る基板の流体処理方法である。

【0015】この流体処理方法は、被処理基板を保持するチャック機構と、前記被処理基板の表裏両面に対向し、かつこれら対向面に流体通路となる隙間を形成して設けられた処理板と、前記被処理基板と処理板とを相対的に回転させながら前記処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する手段とを有する流体処理装置であって、前記処理板を表面固有抵抗が1GΩ以下である導電性材料で構成すると共に、前記処理板をアースに接地して構成して成る基板の流体処理装置によって、実現できる。

【0016】一般に静電気を除去するためには構造材料を非帯電材料とし表面固有抵抗が1GΩ以下であることが必要といわれている。したがって、処理板に帯電防止効果を発揮させるためには固有抵抗1GΩ以下としてアース接地することが必要である。

【0017】上記処理板は静電気の発生がなく、さらに

板状材料である被処理基板上にも静電気の発生がないことから、乾燥不良は発生しない。

【0018】第二の手法の特徴は、被処理基板の表裏両面とそれらに対向して設けられた処理板との間に流体通路となる隙間を形成し、被処理基板と処理板とを相対的に回転させながら処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する工程を有する流体処理方法であって、前記処理板の少なくとも被処理基板に対向する表面を固有抵抗が1GΩ以下の導電性材料で被覆処理すると共に、前記処理板の被覆処理された表面をアースに接地させた状態で被処理基板の表面を流体処理する工程を有して成る基板の流体処理方法である。

【0019】そして、この流体処理方法は、被処理基板を保持するチャック機構と、前記被処理基板の表裏両面に対向し、かつこれら対向面に流体通路となる隙間を形成して設けられた処理板と、前記被処理基板と処理板とを相対的に回転させながら前記処理板の中央部から流体を注入して前記流体通路となる隙間に流体を供給する手段とを有する流体処理装置であって、前記処理板の少なくとも被処理基板に対向する表面を固有抵抗が1GΩ以下の導電性材料で被覆処理すると共に、前記処理板の被覆処理された表面をアースに接地して構成して成る基板の流体処理装置によって、実現できる。

【0020】この第二の手法においては、処理板を例えばセラミックやプラスチック等の絶縁物、もしくは高抵抗の金属で構成する場合に適している。

【0021】上記導電性材料で表面を被覆した場合も、第一の手法と同様処理板および被処理基板への静電気の発生が起こらないため、乾燥不良を防止できる。

【0022】第三の手法の特徴は、上記第一の手法における処理板（固有抵抗が1GΩ以下である導電性材料）の少なくとも被処理基板に対向する表面を耐薬品性処理を行った処理基板で構成することである。これによって、各種の処理薬液を処理流体として用いることができ、処理板の耐用時間を延ばすこともできる。この場合の耐薬品性処理としては、例えば、ダイヤモンドコーティング、導電性のポリテトラフルオロエチレンやポリエーテルエーテルケトン等の材料を被覆する処理が適用できる。

【0023】なお、上記の各方式において、被処理基板と処理板とを相対的に回転させる方式としては、例えば①被処理基板を回転させ処理板を固定しておく、②処理板を回転させ被処理基板を固定しておく、③被処理基板も処理板も回転させる（この場合、互いに逆方向に回転させるか、同方向の場合は回転速度を違わせる）等がある。

【0024】いずれの回転方式でも実施できるが、とりわけ①の方式が他に比べて可動部分が少ないだけ装置構成が容易となり実用性に優れている。この場合は、被処理基板を保持するチャック機構に回転機能を持たせればよい。

【0025】

【発明の実施の形態】ここでは本発明を洗浄装置に適応した場合を例にして説明する。図1は本発明洗浄装置の要部を模式的に示した断面概略図である。図1において、3及び5はそれぞれ処理板となる上部洗浄板及び下部洗浄板であり、その中央部にはそれぞれ流体供給口3a及び5aが設けられている。4は被処理基板、6は被処理基板を保持するチャック機構を備えた基板保持装置を示している。

【0026】上部洗浄板3及び下部洗浄板5は、それぞれ被処理基板4との間に一定間隔の隙間を形成して配設されており、この隙間には流体供給口3a及び5aから洗浄に必要な流体が、洗浄工程にしたがって順次供給され、被処理基板の流体処理が行われる構成となっている。すなわち、流体供給口3a及び5aには、洗浄工程にしたがって、洗浄液、リンス液、乾燥用ガス等が切換バルブによって順次供給される構造となっている。

【0027】そして、これら洗浄板3、5の少なくとも被処理基板に対向する表面の導体部は、それぞれアース接地され洗浄板が帯電しない構造となっている。

【0028】この装置では、洗浄板3、5を固定し、被処理基板4を保持した基板保持装置6が回転する構成としたが、それとは逆に基板保持装置6を固定し、洗浄板3、5を回転させる構成とするか、更にはこれら両者を回転させる構成としてもよい。ここで重要なのは、処理板となる洗浄板3、5と、被処理基板4とを相対的に回転させることであり、それによって流体が隙間を流れ被処理基板4の表面が流体によって均一に挟持されるようにすることである。

【0029】処理板となる上部洗浄板及び下部洗浄板3、5としては、例えばステンレス等の耐食性金属、導電性カーボン、さらにはプラスチックに導電性物質を分散させて導電性を付与した導電性プラスチック成形体などの導体が使用され、これらの中から洗浄液の種類によって耐食性のある材質を適宜選択すればよい。また、処理板となる基材が絶縁材のように高抵抗材の場合には、処理板表面に導体層を被覆するなどして表面を導体化すればよい。

【0030】被処理基板4は、例えば半導体基板（ウエハ）、磁気ディスク基板、光ディスク基板、液晶基板等、洗浄目的によって適宜選択される。そして、被処理基板4はチャック機構を備えた基板保持装置6によって着脱自在に保持される。

【0031】なお、この例では被処理基板4の両面を同時処理する流体処理方法及び装置について説明したが、必要に応じ片面のみを処理することも可能である。その場合には、上部洗浄板及び下部洗浄板3、5のいずれか一方の流体供給を停止すればよい。また、始めから片面のみの流体処理を目的とする場合には、上部洗浄板及び

下部洗浄板３、５のいずれか一方を省略し、装置構成を簡略化することも可能である。

【００３２】

【実施例】以下、図１に示した洗浄装置を例に本発明の基板の流体処理方法及び処理装置について説明する。〈実施例１～２〉基板４は、基板保持装置６によって保持され基板保持装置６を中空モータで回転させる。上部洗浄板３および下部洗浄板５は固定されている。処理流体は上下洗浄板の中央部より切り替えバルブによって洗浄液・リンス液・乾燥用窒素が順次供給される構造となっている。

【００３３】静電気の発生を防止するために、上部洗浄板３に導電性カーボン材料を用いアースに接地した。図６に乾燥処理後の洗浄板表面の静電気電位測定結果を示す。この図から全面で静電気は全く発生していないことがわかった。

【００３４】また、洗浄処理工程の条件は、以下に示す比較例（従来例）と同様であり、結果を表１にまとめて表示した。

【００３５】従来例として、ポリテトラフルオロエチレン製の上部洗浄板３を用い、本発明例としてカーボン製（実施例１）およびカーボン被覆したポリテトラフルオロエチレン製（実施例２）の上部洗浄板３を用いて比較実験を行った。

【００３６】また、従来例、本発明例どちらも下部洗浄板５はポリテトラフルオロエチレン製を用いた。被処理基板４としては、乾燥不良の発生を確認しやすくするために、５００ｎｍの段差をつけた微細パターンに上にリンをドープしたポリシリコンを成膜したシリコンウエハを用いた。

【００３７】先ず、基板４の被処理面となるシリコンウエハのリンをドープしたポリシリコン成膜面を、上部洗浄板３に対面するように基板保持装置６に保持する。

【００３８】次いで、基板４を１００ｒｐｍで回転させ、汚染を除去するためにアンモニアと過酸化水素の混合水溶液で処理し、超純水でリンスを行った後、自然酸化膜を除去するためにフッ酸水溶液で処理し、超純水でリンスを行った。その後、基板の回転数を１０００ｒｐｍに上げると同時に窒素ガスを供給し乾燥処理を行った。

【００３９】処理後の基板表面（リンをドープしたポリシリコン成膜面）を走査電子顕微鏡で全面観察し乾燥不良の発生数を数えた。表１にその結果を示す。

【００４０】表１に示す通り、本発明により全く乾燥不良の発生のない処理を行うことができた。

【００４１】

【表１】

〈表１〉

処理板３の仕様	乾燥不良数（個／８インチウエハ）
カーボン製洗浄板　（実施例１）	0
カーボン被覆ポリテトラフルオロエチレン製洗浄板（実施例２）	0
ポリテトラフルオロエチレン製洗浄板　（比較例）	２５

【００４２】〈実施例３〉被処理基板４としてアルミ合金基板の両面にＮｉ－Ｐめっき膜を形成した磁気ディスク基板を試料して洗浄処理を行った。処理板となる上部洗浄板３及び下部洗浄板５ともに実施例１と同様の導電性カーボン材料を用い、それぞれアースに接地した。流体供給口３ａ及び５ａからそれぞれ周知の洗浄液、リンス液、乾燥用ガスを順次供給し、実施例１と同様の方法で洗浄・乾燥処理を行った。その結果、基板４の両面ともに良好な洗浄効果が得られた。

【００４３】

【発明の効果】以上詳述したように、本発明により所期の目的を達成することができた。すなわち、本発明の流体処理方法および流体処理装置を用いることによって、基板の乾燥不良を発生させずに処理を行うことができる。

【図面の簡単な説明】

【図１】本発明装置の要部断面概略図。

【図２】従来装置の要部断面図。

【図３】従来装置の洗浄板表面に発生した静電気電位を洗浄板中心からの距離との関係で表示した特性図。

【図４】従来装置によって発生した基板上の静電気電位を洗浄板中心からの距離との関係で表示した特性図。

【図５】従来装置によって基板上に発生した乾燥不良の分布図。

【図６】本発明装置の洗浄板表面に発生した静電気電位を洗浄板中心からの距離との関係で表示した特性図。

【符号の説明】

１…洗浄板、

１ａ、１ｂ…流体供給口、

２…基板、

３…上部洗浄板、

３ａ…流体供給口、

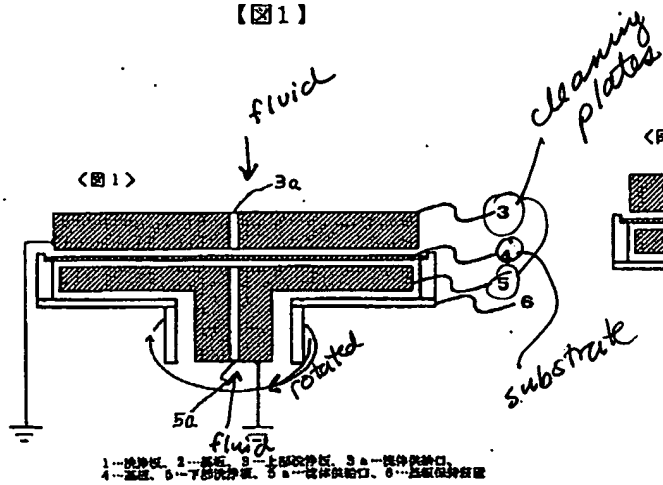
４…基板、

５…下部洗浄板、

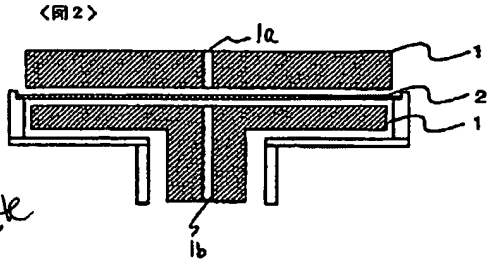
５ａ…流体供給口、

６…基板保持装置。

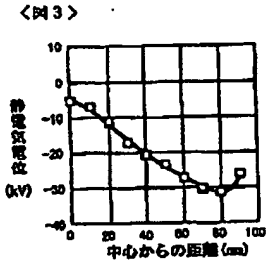
【図1】



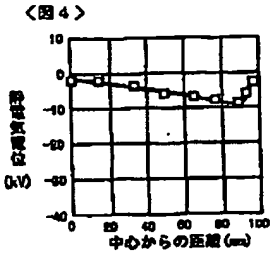
【図2】



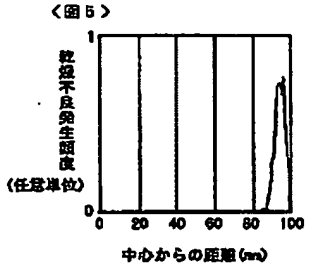
【図3】



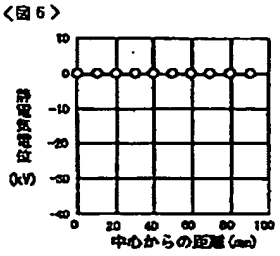
【図4】



【図5】



【図6】



フロントページの続き

(72)発明者 佐伯 智則
神奈川県横浜市戸塚区吉田町292番地 株式会社日立製作所生産技術研究所内
(72)発明者 大録 範行
神奈川県横浜市戸塚区吉田町292番地 株式会社日立製作所生産技術研究所内
(72)発明者 田中 雄一郎
神奈川県横浜市戸塚区吉田町292番地 株式会社日立製作所生産技術研究所内
(72)発明者 相内 進
神奈川県横浜市戸塚区吉田町292番地 株式会社日立製作所生産技術研究所内
(72)発明者 岡 齋
富山県婦負郡八尾町保内2丁目1番地 国際電気株式会社富山工場内
(72)発明者 森田 富実雄
富山県婦負郡八尾町保内2丁目1番地 国際電気株式会社富山工場内
(72)発明者 藤城 雅隆
富山県婦負郡八尾町保内2丁目1番地 国際電気株式会社富山工場内
(72)発明者 山岡 明暢
富山県婦負郡八尾町保内2丁目1番地 国際電気株式会社富山工場内